THE MAC Flyer

NOVEMBER 1983

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THE MAC Flyer

For Greater Safety in MAC Air Operations

NOVEMBER 1983 MACRP 127-5 VOL XXX NO. 11

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As of 1 November 1983, there are only 152 days left! "Left to what?" you might ask. Good question, ink breath. There are only 152 days left for you—yes *you*— to submit your prize-winning entry to the 1984 MAC Flying Safety Writing Contest.

"Is there more?" But of course! In addition to receiving an original and highly prized C.R. Terror T-shirt, each author submitting an entry will also get a 1-year paid subscription to *The MAC Flyer*. Just for entering! If you should win first, second or third place, you'll also receive a handsome engraved desk set. Should you be one of the nine honorable mention winners you'll be awarded an engraved wall plaque.

All you need to do is grab your trusty microcomputer, buy an extravagant word processor and compute us a winning entry. Well actually, all we need for you to do is beg or borrow a typewriter and pound out your story—be it poetry or prose. Then proofread, revise and proofread again. Finally, send it off to us (two copies, double spaced, of course).

A couple of hints for those of you who have never entered our contest. First, each entry *must* have an aviation safety/mishap prevention message! *Absolutely, positively, no exceptions!* Secondly, all work must be original and unpublished. Copyright violations tend to give our editors anxiety attacks. Finally, stick to the suggested lengths for submissions. (See the rules.)

That's it. A literary piece of cake. But don't procrastinate. March 31 will be here before you know it, so get busy and write a masterpiece. We already have *your* C.R. Terror T-shirt waiting to be mailed.

Good luck from *TMF*! ★

The Rules

The 1984 MAC Flying Safety Writing Contest is conducted according to MACR 900-3 and these rules. All entries must be original, unpublished and postmarked no later than 31 March 1984. Stories must be between 1,000 and 3,000 words long (about 6 to 14 double-spaced typed pages); poetry should be about 75 to 100 lines. Entries must contain an *aviation safety/mishap prevention message.* Manuscripts must be double-space typed and submitted in *two copies.* Identify entries by title only and attach a cover sheet showing the author's name, address, duty phone number and unit. Also, the cover sheet should contain a brief autobiography.

The contest is open to anyone. Entries qualifying under the above rules earn their author a free C.R. Terror T-shirt (*so indicate your size*) and a free 1-year subscription to *The MAC Flyer.* However, contest prizes (desk sets and plaques) may only be awarded to military members and civilian employees of the Department of the Air Force or Air Reserve Forces. Other entrants may be selected for Honorable Mention in a Special Category. All winning stories will be published in *The MAC Flyer.* Entries should be addressed to:

Safety Writing Contest
HQ MAC/IGFE
Scott AFB, IL 62225

C-5 Color Weather Radar

Colorful tips on your C-5 and C-141 radars

Turn it on and see the world in bright colors; red, yellow, green or blue. A MAC video action game for C-5 troops? Not exactly. It's the AN/APS-133 color radar now being installed on our Galaxy fleet. Already on C-141 Starlifters and KC-10 Extenders, the new radar features a four-color presentation, digital scope, beacon mode, ground mapping mode, and a high mean time between failure. It's also easy to fix and easy to use! But it's not a case of "turn it on and it works." As a C-5 crewmember, you'll need to spend some time gaining familiarity and expertise with the new radar.

Normal Operations

There are several rules you'll need to know before operating the new radar.

First, if you don't need it—turn it off! with other radars, we normally put the radar into "standby" when not in use. For the C-5 radar, however, you should shut it down if use of the radar system is discontinued during flight for extended periods.

Second, if you do need the radar, make sure you turn it on in time. Remember, it takes 3 minutes to warm up, so plan ahead. For maximum safety, you'll want to make course corrections for significant weather prior to the 100-mile range on the scope. Don't wait until you've got the first of a 60 mile line of thunderstorms filling up the wind screen and you find yourself with slim-to-no options with your radar still off.

"Zero" tilt—less than 50 nautical mile range means GO AROUND. Colors indicate rainfall rates on the APS-133 radar: Green, light rainfall; Yellow, moderate rainfall; Red, heavy rainfall.

Altitude	Tilt Setting	Range Miles
Climb		
Takeoff	4° - 5° up	25
10,000 feet	3° up	50
15,000 feet	2° up	150
FL 200 feet	1° up	150
FL 250 feet	0° up	150
Cruise	1° - 1.5° down (Adjust as needed)	150-300
Descent		
Above Fl 250	3° down	150
FL 250	2° down	150
FL 200	1° down	150
15,000 feet	0°	150
10,000 feet	1° up	50
5,000 feet - landing	2° up	25

Figure 1, APS-133 Suggested Color Radar Tilt/ Range Schedule.

A third rule is to be conservative when it comes to thunderstorms. A good weather briefing before the flight should tell you where the worst weather is expected. Above FL 230, avoid thunderstorms and their associated lightning and hail hazards by a *minimum* of 20 miles—always! While your new radar gives you more range, it's not as sensitive to picking up all the fringes of a thunderstorm as the old C-5 multimode radar was. Since these fringe areas are also on the tops of storms, don't fly over them when you can't be sure how much clearance you have over the top. Chances are the storm that appears low at 100 nautical mile range may very well tower above you by the time you get to it.

This brings us to the troublesome issue of weather penetration. The manufacturer clearly states that the radar is for weather *avoidance*. Plan on keeping it that way. However, you won't always be able to miss all the weather. Your radar will display the various levels of precipitation on the indicator as green (light), yellow (moderate), and red (heavy) precipitation. You should consider red returns rock hard. *Never* fly through red. According to the manufacturer, red is

by Captain Peter R. Mooy
USAF Airlift Center
Pope AFB, North Carolina

indicative of hazardous conditions with turbulence. Some crews have reported entering light rain with the scope going red supposedly indicating severe thunderstorms. This is a normal indication when penetrating rainfall. If this happens, reduce the gain to find the safest path out of the weather.

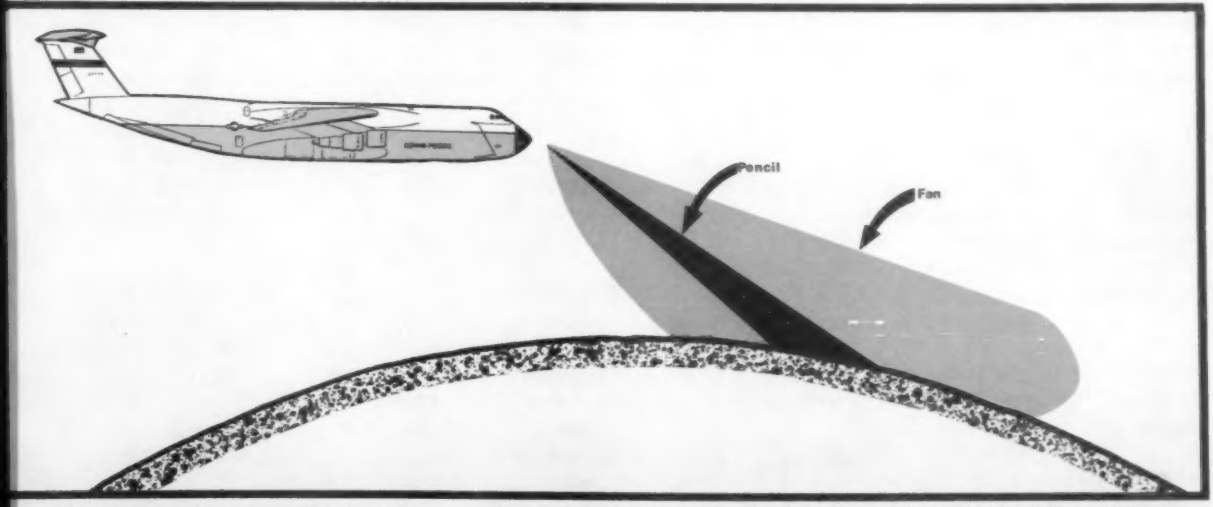
Radar Interpretation and Tilt

Tilt is the most critical adjustment for accurate radar interpretation. With tilt, you'll be able to get rid of the pesky ground clutter that can be distracting and deceiving. You may also want to establish a preset routine to change your radar's tilt—a tilt schedule, in other words. (See Figure 1). While no tilt schedule will cover every situation, having one can help you when the roof caves in with emergencies, deviations and checklists.

Before departure, the commercial pilot handbook recommends first scanning the area with several sweeps while moving the tilt from +7° to +15° during the taxi. Change the range around to give yourself the most information for deviation planning. If it's a clear day, look at the most distant target you can for a confidence check. For takeoff, set the tilt at 4° to 5° up to see where you are going. As you continue to climb, reduce the tilt by one degree starting at 10,000 feet, then one more degree every 5,000 feet until you get to zero. By forcing yourself to change the tilt on an easy to remember schedule, you'll find yourself looking at the radar more.

At cruise, an accurate tilt will give you the most warning of storms ahead. If you're cruising above FL 250, use 1° to 1.5° down to see ahead. You want to get a look at storms which may be growing as well as mature full-blown CBs. Selecting a 300 mile range allows you more information for altering course. However, a 150 mile range will give better target definition. By "walking" both tilt and range setting, you'll be able to keep the target on the scope. A target painting at 180 miles may not paint at 60 miles if it is below the radar beam. If you can paint a target inside 50 miles range at cruise altitude with 0° tilt set, you better go around it. Again, being conservative is being safer.

Now that you've successfully gone around the storms at cruise, you're ready to begin your descent and approach. Naturally, metro



Fan antenna beam provides broader ground mapping coverage. Illustration adapted from Bendix "RDR-1FB (AN/APS-133) *Pilot's Manual.*"

APS-133 radar scope installed at the C-5A pilot's station.

APS-133 radar scope installed at the C-5A copilot's position.

forecasts scattered thunderstorms for both descent and destination. Since you'll have other pilot responsibilities during the descent, again consider using a tilt schedule. Select weather mode and 150 mile range with the tilt at 3° down if you're over FL 250. This will give you ground and weather returns at about 90 miles range. With this, you'll get a look at low weather that could effect your course at lower altitudes. At FL 250, change the tilt to 2° down to keep the picture in the same perspective. Set 1° down at FL 200. At 15,000 feet put the tilt at 0° to help eliminate ground clutter from the weather returns. This will leave prominent terrain features on the scope. At 10,000 feet, set 1° up tilt to remove clutter but not significant weather or mountains. At 5,000 feet go to 2° up to keep out clutter. Your range should have come down as well. Select 50 miles when 50 from destination and 25 miles as needed. Do this even if weather isn't a factor; it'll be good practice.

An additional pilot responsibility is monitoring terrain—knowing where you and the thunderhills are! Review the terrain before descent. Crosscheck your position with several aids. Know where the heading is taking you. Terrain can give you trouble any time, but especially when you're flying other than the normal published routings or approach paths. Be on the lookout when you get strange vectors for whatever reason (such as altering around weather or other traffic). Don't try fancy switching of the radar. The weather mode gives you everything you need with its pencil beam and automatic sensitivity time control (STC). Try picking a fixed point on the scope you can positively identify, then determine where you are. From there, make sure the directions ATC gives you are clear of terrain. Then make sure you fly those safe instructions.

Degraded Ops

Be ready when your radar gives you degraded performance. If you get radar interference, reducing the gain will eliminate some of the clutter, but will also take away targets. If you get less radar range than normal, the sensitivity of your set is probably down and will need to be adjusted by maintenance. If you lose stabilization to the antenna, C-5 crewmembers can change

control of the radar to the other pilot or select another INS. Any of the three INSs can provide stabilization, depending on which pilot has control and which INS is displayed for course guidance. If the radar won't accept a "stab" source, choose stab off. In this mode, the radar won't be usable in turns and will distort when pitch angles change, but will still work in level flight.

Recognizing Malfunctions

If you see a picture that's very odd, perhaps one side of the scope is flooded in returns or a large stripe exists, the stab may have failed. In this case, turn to the "test" mode and look for RT or ANT lights. Remember these lights are only displayed in "test." Try changing the stab source or select stab off.

Another problem you can recognize quickly is roll error. The radar should provide a balanced picture with a symetrical "doughnut" when the antenna is pointed "max" down over smooth terrain or water. If the band is skewed to one side, the antenna has a roll error. To determine the amount of error, pick a display at something less than "max" down tilt. Note the tilt settings and check the range of the closet targets. Now lower the tilt until the targets on the other side of the display are as close as the first setting was. Compare the tilt readings to determine the error. Write up anything more than 0.5°.

To check if your tilt control is calibrated correctly, lower the tilt control to 4.5° down. If you're over FL 310 and the terrain is within 1,000 feet of sea level, you'll get a ring of targets at approximately 60 nm. If the ring is less than 60 miles, the antenna is pointing too low; more than 60 miles, the antenna is too high.

Final Tips

The APS-133 radar works well and will give you accurate weather information you can trust. Land/water contrasts are easy to distinguish. Tracking the well-defined coastlines will give you an additional navigational crosscheck.

You can spend a lot of time trying to determine heights of clouds, but don't. Clouds don't paint on radar. On the other hand, rain or hail will paint and are usually concentrated in the lower levels of a storm.

You may be concerned over how to differentiate between weather and terrain. The rule is pretty simple. If you're not sure, go around the return. Besides, there are not many weather returns you should fly through, and none you want to!

A last tip is to make good radar write-ups. The maintainers need you to indicate settings, modes and ranges when you get problems. Be able to draw a picture if necessary. If all you write is "radar inop," maintenance will only think the radar won't turn on.

Conclusion

With the change to a C-5 color radar, it's time to review our radar knowledge as well as the specific operating procedures of this system. Getting into the "books" and refining our radar operating techniques will pay us big dividends in handling those future weather and terrain avoidance situations. With a little practice, and some basic radar knowledge, you'll find the new C-5 color weather radar is just the thing you need to keep yourself out of the red and out of the weeds. Who knows, maybe later we'll even find a place to plug in the video game cartridges? ✈

ABOUT THE AUTHOR

A graduate of Florida State University with a master's degree from Southern Illinois University, Captain Mooy has served as an instructor navigator at Dover AFB, Delaware, and as an instructor at Squadron Officers School at Maxwell AFB, Alabama. Captain Mooy presently serves as chief of the C-5 Navigation Branch, USAF Airlift Center, Pope AFB, North Carolina.

Advanced Airlift Tactics Training Center

Realistic Training for Tactical Crews

Extra restraint is an important safety factor. Loadmasters from the 172d TAG, Mississippi ANG, demonstrate "how to do it right."

Official USAF photos by SSgt Mark Pickeral.

by Captain Byron L. Howard
Associate Editor

Airline pilot. Executive employment specialist. Propane gas dealer. Farmer. These occupations don't seem to have much in common, but the men who possess these and other varied skills have one common bond. What brings these men together, however, is more than just their shared love of flying. Together, these dedicated Air Guardsmen from Missouri's 139th Tactical Airlift Group, St. Joseph, form the cadre of a unique combat training program aimed at improving the overall readiness of MAC's Air Guard combat airlift forces, and potentially both Air Reserve and active duty forces as well. This program is the Advanced Airlift Tactics Training Center (AATTC).

The concept of improving airlift tactics through a structured course isn't unique to the Air National Guard. Other active and reserve units have "hostile environment" training programs. (See "Hostile Environment Training," *TMF*, July 1983.) What's unique about the ANG concept are the potential numbers of participants--MAC's Air Reserve Forces and active duty aircrews. The course is designed to train line aircrews in tactics and techniques derived from Red Flag, as well as to update those tactics currently taught by local units. In all, the purpose of the AATTC is to provide aircrews with the knowledge and skills they will need to successfully accomplish MAC's wartime mission—to fly, fight and survive!

Editor's Note: MAC started its Combat Aircrew Training School (CATS) in September. Although the overall goal of both

CATS and AATTC is similar, i.e., increased combat readiness of tactical airdrop forces through training, the programs are different in their approach. CATS will train unit instructor pilots, instructor navigators, and intelligence officers and NCOs in a 3-week, non-flying course at Nellis AFB, Nevada. These instructors will then return to their units to provide the nucleus of an in-unit combat aircrew training program. AATTC, on the other hand, provides both academics and intense flying in a very rigorous 8-day course for line crews.

Major Howard Dixon, AATTC director, gave *TMF* a brief history of the course. "Basically, we (ANG personnel) went to our first Red Flag in December of '81 and found out that the standard tactics we used then just didn't work," he stated matter-of-factly. But Major Dixon and other C-130 crewmembers took the lessons learned at that Red Flag back to their units and developed a concept to train aircrews realistically. "We took our aircrews through the low-level awareness training (LLAT) that the 162d Tactical Fighter Training Group developed for their A-7s. We researched and developed tactics we felt would work," explained Major Dixon. "Then we went back to Red Flag and successfully completed the exercise with no confirmed C-130 losses. In fact, the aggressor pilots spent 20 minutes describing our tactics in the mass debriefing." From those early ideas came the concept of a centralized training facility to teach ANG airdrop aircrews the latest in tactics while providing actual hands-on training to reinforce the classroom concepts. The National Guard Bureau agreed with the concept and scheduled a series of Service Test Evaluation Program (STEP) tests.

Validating the Course

The first STEP test provided a course for four crews from different units, flying four different C-130 models. From 24-30 January 1982, crews from the 164th TAG (C-130A), 179th TAG (C-130B), 146th TAW (C-130E), and 172nd TAG (C-130H) went through the course, then critiqued the program. With

Major Bob Agee, center, and Captain Steve McCamy, left, wear flight helmets and restraining harnesses on the flight deck to keep from becoming "flying objects" during a low-level training mission.

Major Bob Agee, AATTC instructor, goes over the finer points of mission planning with an aircrew from the Mississippi ANG.

Army helicopter playing the part of a "Hind-D" makes the AATTC training more realistic.

every model of the C-130 represented, the AATTC instructors could ensure the subject matter would be applicable to all C-130s. In July of the same year, four crews from the 118th TAW participated in the second STEP test dedicated primarily to low-level awareness training. Then, to validate their methods, AATTC instructors flew with the 118th as observers at Red Flag. The highly successful results proved the value of the course. But still more refinement was needed.

In October 1982, crews from the 135th TAG, Baltimore, went through the AATTC. They had just transitioned into the C-130 from the O-2 and C-7. This test also included a crew which had not been through the AATTC. In addition, two crews from the 167th TAG participated. They had been through Red Flag before, but had not been through the AATTC. After the final flight, the crews who had completed the ATTC performed as well as those crews who had seen Red Flag before, and much better than those who had not.

Course Content

Very compact, the program combines a series of actual flying events and academic subjects into one concentrated course. The first day is all academics and discusses:

—Low-level awareness training
—Soviet tactical SAMs
—Aircraft recognition training
—Aircraft interior preparation and personal restraint
—The air tasking order

The LLAT classroom briefing also presents some sobering footage of low-level visual illusions which drives home the seriousness of the subject—low-level flying can't be taken lightly!

The second day is divided into academics in the morning and an airdrop mission in the afternoon. Courses for the day consist of:

—Low-level navigation training (LLNT)
—Strike package development
—Escape and evasion
—Mission planning

After lunch, the crews draw survival vests and parachutes from the 139th TAG life support shop for the flight. The purpose of the survival vests and 'chutes is to develop a psychological mind set for the flight. In other words, the flight is not just another "flag pole" mission, but a flight through a simulated combat environment.

The local mission is straightforward, consisting of one low-level route, a heavy equipment drop and a recovery to a short-field landing. AATTC instructors are also sent out along the route to simulate SAM and "triple-A" sites, all of which have been briefed to the aircrews. The instructors, using "solar-powered" flash producers (signal mirrors), "fire" at the Herks, each of which has an AATTC instructor aboard. Don't laugh! The flashes produce the desired effect, and an aircrew's evasive maneuvers to the simulated SAM or AAA firing are recorded on video tape for the debriefing after the flight.

The instructors' high regard for safety is also evident in every phase of the course. From the first flight on the St. Joseph low-level routes until the last day's final flight, the instructors stress important operational safety factors—aircraft performance parameters, physical restraint of everyone in the airplane, protective equipment, etc. The instructors emphasize safety by wearing restraining harnesses (hooked into rings installed behind the pilots' seat tracks) and helmets to minimize the chance of injury

while flying in the turbulent low-level environment.

The third day starts with lectures on:

—Soviet anti-aircraft artillery
—Chemical-biological-radiological warfare
—Radio electronic combat

In the afternoon, the crews fly a low-level CDS airdrop mission which completes their flying in the St. Joseph area.

The next morning's academics include presentations on Soviet doctrine, the Soviet air-to-air threat, and locating and acquiring

Down and Dirty—a Mississippi ANG C-130H at 300 feet AGL somewhere over the Arizona desert.

enemy ground-to-air and air-to-air threats. After lunch, it's on to Davis-Monthan AFB, Arizona, for some high desert flying.

LLAT and LLNT

Moving the flying operations to the arid desert and mountains of southern Arizona presents the aircrews with a special set of flying safety problems. Particular emphasis is placed on terrain clearance while continuing to use terrain-masking techniques, low-level navigation techniques and flying the Herk within the limitations of the Dash One. The instructors advance the aircrews a little at a time, allowing sufficient time for the crews to accustom themselves to the special safety problems of flying in the desert and mountains.

"We have two kinds of routes out here—the LLAT and the LLNT routes," explained Lieutenant Colonel Carl Firkins, instructor navigator and air ops officer for the 139th TAG. "We start the crews off at 1,000 feet AGL on each route. Then we take them down to 500 feet AGL. Finally, when every man on the crew is ready, we go down to 300 feet AGL."

Major Bob Agee continued, "Two of the four crews will see the LLAT circuit in the morning, for example, while the other two crews will see the LLNT route. Then, the crews will 'flip-flop' in the afternoon."

The next day, the aircrews fly the same routes, starting at 300 feet AGL for the LLAT circuit only, again flip-flopping routes in the afternoon. This time, even more emphasis is placed on aircraft performance limitations, threat detection, low-level navigation techniques and terrain-masking techniques.

Colonel Firkins made one final point. "In the end, the technique we emphasize on the LLNT route is tick marks and time; on the LLAT circuit, the emphasis is on aircraft performance and building confidence."

The last day is the "graduation flight," and consists of two low-level routes to two different drop zones using all the techniques taught in the previous week. The instructors also thought a dogfight with an A-7 and an Army chopper would add realism, so the aircrews have that to deal with in addition to the ever-present video tape "gun." In all, its an hour and a half of the most intense flying this side of Red Flag. But even though the flight is "fun," it's a good feeling to hear the A-7 call "knock it off."

Lessons Learned

The AATTC is now open for business, and many of you ANG, reserve and maybe even some of you active duty airlifters will have a chance to experience this intense course. Make the most of it, for although it's some very intense training, flying safety is emphasized.

Before his retirement, Major General Stanley F.H. Newman, ANG Assistant to CINCMAC, had an opportunity to see the AATTC in action. "I consider the AATTC's program to be outstanding—extremely well conceived, planned and executed," he said in a letter to the National Guard Bureau. "Their approach is conducive to flying safety and at no time did I have any apprehension that safety of flight was in any way compromised, to the contrary, *flying safety appeared to be paramount.*" ✈

We Did It That Way In

A Herk crew learns about judgment

by Captain Matthew J. Chappell, II
773 TAS
Dyess AFB, Texas

"Everybody have a good rest?" Alan Carson cheerfully queried his crew as he bounced up the crew bus steps. Answered only by some unintelligible grunts and closed eyes, the young AC knew that 5 days on the road were taking their toll, and that it had been an exciting Friday night at the Lajes clubs. The relatively balmy weather, easy loads and good support at each stop between Dyess and Frankfurt had made this January jaunt a refreshing change from a West Texas local tac trainer. However, each of Mother MAC's sons was ready to take it to the barn after a long week's work.

"I just can't wait to get home to a *real* bed," grumbled Larry Marting, the loadmaster. "Those combat cots in the Qs are hard on my back!"

"Yeah, but at least the price is right," reminded Neal Newcomb, the old-head navigator who had slept in everything from a hootch in Thailand to the VIP quarters at Andrews. Neal was approaching retirement. His twentieth anniversary was "double-scheduled" for the last day of this trip. He had missed his share of birthdays and anniver-

Honorable Mention, 1983 MAC Flying Safety Writing Contest

Vietnam

saries, and was very anxious to be home for this special one. Besides, every flight before starting terminal leave was like cheating death—he had known too many aviators who met premature fates within months of retirement.

Arriving at the aircraft, Alan reminded the engineer, Frank Elliott, to check the number 2 bleed air regulator, which had been slow to operate ever since the trip started.

"We'll be back in a little while, and hopefully get out of here early," Alan called as the last bags were unloaded and the coffee and water jugs hauled aboard. During the ride to base ops, he reflected how much his copilot, Clay Penny, had improved in the past week. He was really trying to stay ahead and anticipate events, and had even called in their lunch order the night before. Alan felt proud of the pointers he had passed along to "the kid," and hoped to show him more today.

The command post controller greeted the weary world-wanderers by launching into a briefing about their maintenance status, fuel, airfield hazards, and a dozen other things they already knew about. The crew obligingly listened, but Alan perked up when the briefer mentioned "assorted Navy equipment" as part of their load. He was leery of anything gray, knowing his sister servicemen could come up with some real "one-of-a-kind" loads.

The navigator interrupted with, "Maybe we'd better top off the fuel—the only alternate within range is Myrtle Beach, and the weather along the coast isn't real sterling today." Alan perused the computer flight plan for a minute, noting headwinds of only 70 to 80 knots, agreed, and asked the controller to send a truck out to max out their tanks. "Oh yeah, how about asking 21st if we can go early?" he added as the crew turned their attention to flight planning.

Thirty minutes later, complete with a bag of box lunches and approval for an early departure, the three officers headed to their trusty Herky bird, only to find it had developed a few problems overnight. "Nothing big," said the engineer, "just the number 2 fuel tank gauge off-scale and a little oil under number four. I've seen worse." The engineer had his reasons for being optimistic. As the head of squadron

> "My wife will kill me if I'm not back."

OJT, he had a report due to the wing the day after his return. He was especially eager to get it in on time, as the last two reports had been late. "The bleed air regulator is still slow, but at least it works."

Alan climbed the flight deck ladder to find Clay checking their fuel, ensuring they had enough gas for the long flight back to Charleston. In the back, Larry had the load nearly secured—two antique-looking power carts and three pallets of Navy goodies piled up close to the ceiling. Checking the weights in his mind, Alan added up 156,000 pounds—just over max gross! "But we'll burn a thousand during start and taxi, so we'll be OK," persuaded the loadmaster, handing him the Form F. "Besides, in Vietnam we were always overweight, and from shorter fields than this!"

Soon the crew had four turnin' and burnin', but Frank discovered that the number 2 bleed air regulator now refused to close—not such a bad thing unless a leak or fire later on required its closure. The crew quickly discussed and eliminated all the possibilities, from a windmill taxi start to a buddy start from a P-3 ("After all, we're hauling their stuff—it's the least they can do for us!"). Learning from command post that no support was available on weekends, Frank proposed to climb a stand and close the regulator manually after the engine start. "We did that sometimes in Vietnam," the engineer stated. Hesitantly, Alan directed the shutdown and cautioned his crew about the hazardous procedure. They continued with their questionable operation, each breathing a sigh of relief after the sick engine was on-speed and closed up. The rest of the pre-takeoff events went without a hitch. Consequently, Alan began to feel like a real mission hacker, though their early takeoff time had come and gone.

As the heavy Herk lumbered down the asphalt, they all felt that it wasn't accelerating as it should, but shrugged it off "because we've got nearly 2 miles of runway here." Bozo 57 finally wallowed into the air and set course for the land of baseball, apple pie, and radar contact.

"I don't think we'll make FL 240 right off, boss," Clay reported as they passed FL 190 with only 500 feet-per-minute rate of climb. The others agreed and the copilot asked Santa Maria for FL 220. Level-off and acceleration, though slower than charted, went smoothly, and five minds wandered ahead to crew rest, anniversaries, and the Wailin' Willie concert. "We got tickets the first day they were on sale," mentioned Clay, "and my wife will kill me if I'm not back in time! Hope this hog holds up for 2 more days and 21st gets that regulator to Charleston for us by tonight."

Passing over Bermuda, the crew alertly updated the Charleston weather forecast, which remained unchanged—800 feet overcast and 1.5 miles vis—but added rain showers and icing behind a cold front off the coast. After worrying aloud about the icing for a few minutes, the crew convinced themselves that they could get through all right. "Besides," Neal joked, "they would never buy our diverting into Bermuda now!"

Halfway to the coast, however, the navigator noticed their groundspeed dropping steadily—200, 190, 180 knots—and began calculating their fuel consumption one more time. "I suppose we could cruise shutdown one or two engines to save fuel. We did that in ABCCCs in Vietnam—sometimes." Alan sank lower in his seat, furrowing his brow and stroking his chin. His total confidence in his airplane prevailed over thoughts of engines flaming out after landing, and they droned on.

However, as ice began to encrust their wings and their airspeed dropped another 10 knots, Alan stretched, sat up, positioned his mike, and said, "New York, Bozo 57 is diverting to Bermuda. Request course reversal and climb to FL 250."

Protests erupted as the crew recounted their reasons for pressing on, questioning the necessity of retracing their steps with only a couple of more hours to go. But four disappointed flyers settled down to work when the AC informed them, "I hear they did this a lot in Vietnam too—it's called *using your head.*"

ABOUT THE AUTHOR

Captain Chappell graduated from the USAF Academy in 1975 and attended undergraduate pilot training at Webb AFB, Texas. He flew C-130s at Little Rock AFB, Arkansas, prior to his present assignment as a C-130 simulator instructor pilot at Dyess AFB, Texas.

Flying-Hour Milestones

10,000

Col Harry S. Jones, 356 TAS
Lt Col Clayton H. Ford, Jr., 303 ARRS
MSgt Lloyd Anderson, 728 MAS
MSgt Barry Feger, 729 MAS

5,000

Lt Col Edward J. Bruetsch, Det 2, 1400 MAS
Lt Col Kenneth E. Gould, 757 TAS
Lt Col Thomas J. Tatham, 356 TAS
Lt Col Jerry W. McDowell, 729 MAS
Lt Col Michael W. Noonan, 728 MAS
Maj Forrest C. Brown, 86 MAS
Maj Charles A. Coleman, 53 WRS
Maj Steven J. Cummins, 708MAS
Maj Richard T. Dietrich, 757 TAS
Maj Thomas C. Doering, 757 TAS
Maj William J. Dowell, 41 TAS
Maj Mark S. Erickson, 18 MAS
Maj Robert C. Flick, 1401 MAS
Maj Ronald L. Fluitt, 730 MAS
Maj Louis Hari, 356 TAS
Maj Warren C. McCue, 728 MAS
Maj Joseph F. Stribling, 300 MAS
Maj Charles D. Watson, 356 TAS
Capt Robert R. Bologna, 728 MAS
Capt Robert Edwards, 728 MAS
Capt Steven D. Haugland, 729 MAS
Capt Jack L. Hill, 729 MAS
Capt John L Huseby, 730 MAS
Capt John G. Mentavlos, 300 MAS
Capt John K. Murrow, 729 MAS
Capt Robert Olson, 301 MAS
Capt William G. Wade, 728 MAS
SMSgt Lewis W. Blackwell, 315 MAW
SMSgt James L. Hillabrandt, HQ ARRS/DOV
MSgt James W. Allison, III., 53 WRS
MSgt Joseph Beneke, 757 TAS
MSgt John E. Crittenden, 729 MAS
MSgt Ronald J. Kent, 701 MAS
MSgt Marvin B. Lawrence, 356 TAS
MSgt Jack M. Pettit, 345 TAS
MSgt Randolph E. Stubbs, 728 MAS
TSgt Robert J. Bien, 356 TAS

2,500

Maj James M. MacGuffie, Det 5, 39 ARRW
Capt Michael D. Hales, Det 5, 39 ARRW
Capt Michael M. Webb, 1550 FTS
MSgt Garland R. Lewis, Jr., Det 5, 39 ARRW

Ranks and units are those at time of award. See MACR 900-3 for details on how to apply for your own milestone award.

by Captain Gale E. Clouse, Jr.
Associate Editor

Icing: The Visible Hazard

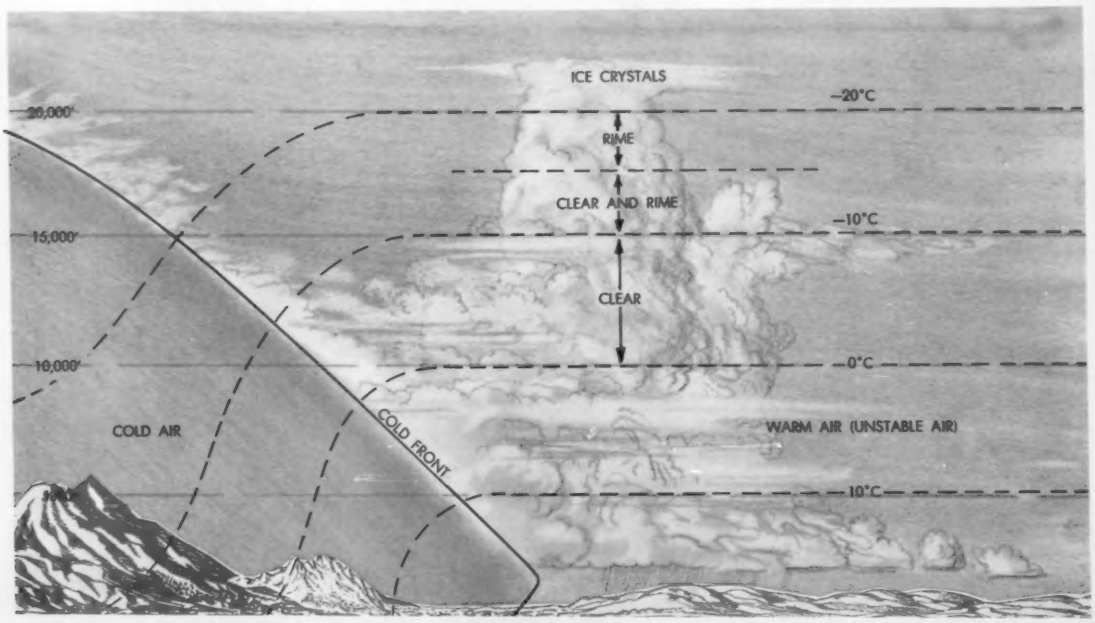
Prepare today for winter weather operations

Line-up checklist, copilot. Scanner says we've got a thin layer of ice building up on the wings," calls the aircraft commander.

"Roger. Let's get this beast off the ground before we get any more," briefs the right-seater.

Was that a good decision? What would you do in this case?

In the conversation above, we see the popular misconception, "a little icing can't hurt us." In fact, a little ice can *kill* you! For example, take ice, frost or snow formations on the leading edge and upper surface of a wing with a thickness and surface roughness similar to medium or coarse sandpaper. That's not too much, you say? And



Cold front icing zone

you're right. That isn't *very* much, yet wind tunnel and flight tests have shown that such ice can reduce wing lift as much as *30 percent* and increase drag by *40 percent.* These changes in lift and drag, in turn, significantly reduce controllability and alter flight characteristics.

Although icing may occur during any season of the year, in temperate climates like the U.S. it occurs most frequently in the winter. So with the winter season rapidly approaching, a review of our icing procedures is clearly in order.

Icing

Aircraft icing is divided into two types: structural and induction. While structural icing affects the exterior of the aircraft, induction icing occurs in the power plant itself. There are three basic types of aircraft structural icing: clear, rime, and frost.

Clear ice, the most serious form of structural icing, is a glossy ice identical to the glaze which forms on trees or other objects as freezing rain strikes the earth. (or your plane!). Clear ice, normally formed at temperatures between O° and -10° C, is most frequently encountered in cumuliform clouds and freezing precipitation.

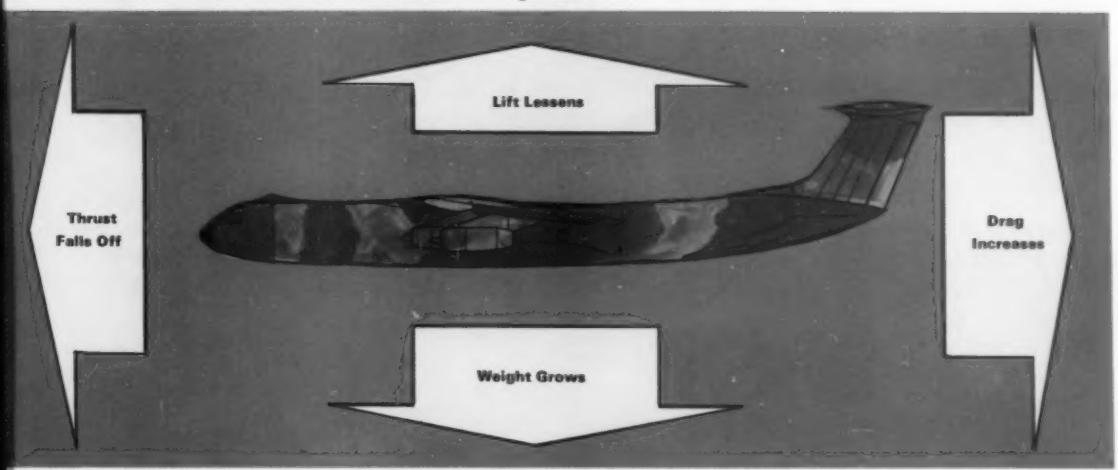
Rime ice is formed when small supercooled water droplets strike the aircraft and instantly freeze. Rime ice, most likely to accumulate in the 0° to -20° C temperature range, is a milky, opaque ice with a rough surface.

Frost, as in "the frost on the pumpkin," forms on the exterior surfaces of parked aircraft when the temperature of the exposed surface is below freezing. In addition to frost, mixtures of clear and rime ice are common in icing situations.

Effects of Ice Formation

As we've seen, ice and aircraft not only mix together, they stick together, affecting aircraft performance and flight characteristics in a most negative manner. Consider these effects of airframe icing:

- Slight surface roughness can significantly increase stall speed and power required to achieve or to sustain flight.
- Surface roughness due to ice formation on wing leading edges and afterbodies will produce additional drag and further degrade aircraft performance.
- Due to increased stall speed, maneuvers should be more gentle. Airspeed during approach should also be increased in accordance with Dash One guidance.
- Stall angle-of-attack will decrease and, in some aircraft, stall will occur prior to activation of stall warning systems.
- Stall characteristics will change. Depending upon aircraft design, the nature of ice formations can cause either violent stall or a slower progression of stall. In some aircraft, pitch-up tendencies may be greater and roll-off tendencies can be exaggerated.



Effects of icing are cumulative, causing stalling speed to increase.

- Power available may be reduced due to ice formations on propellers or jet engine inlets.
- Trim effectiveness can deteriorate with the accumulation of ice on unprotected surfaces.
- Power failures may occur due to carburetor icing or ingestion of ice particles into jet engines or clogging of fuel tank vents and fuel caps.
- Severe vibrations may occur due to asymmetric shedding of ice from propellers or rotor blades. Helicopter autorotation capability can be significantly changed or lost.
- Control surfaces (ailerons, elevators, rudders and wing spoilers) may freeze in place if water deposits, snow, and deicing fluids are not properly cleaned or drained.
- Wing flaps may be damaged if retracted with ice adhering to critical areas.
- Landing gear mechanisms may be damaged or frozen in place if not properly cleared of ice.
- Forward visibility may be lost or significantly reduced if windshield anti-icing systems aren't available, aren't properly used, or are incapable of coping with the severity of the icing.
- Radio, radar, and other communication and navigation antennae may be damaged or have their efficiency reduced due to ice formations.
- Ice formation effects may be more apparent in the event of engine failure or other emergencies.
- Flight, engine, and other instruments are subject to error if ice exists on external probes, in pressure lines, or on areas forward of or adjacent to external probes. Typical sources of error are icing of pitot-static probes used for airspeed, altitude, and engine pressure ratio measurements. (See Dec 82 *TMF*, "The Fatal Flight of Air Florida 90.")

Clean Aircraft Concept

Since clear or rime icing or frost may prove hazardous to your aircraft's health, it's prudent to take the proper precautions. Should we find ice formations on our aircraft, our MAC operational practice is to deice the plane using deicing fluid.

The basic philosophy of using freezing point depressant fluids (FPD) for aircraft deicing is to decrease the freezing point of water either in the liquid or crystal (ice) phase. FPD fluids are very soluble in water. However, the rate at which ice will absorb FPD or melt is very slow. Repeated applications of FPD fluids may be necessary to get the aircraft completely deiced.

USAF aircraft are deiced in accordance with T.O. 42C-1-2, "Anti-icing, Deicing and Defrosting of Parked Aircraft." Although a maintenance technical manual, the T.O. has useful information for operators. The Air Force uses anti-icing and deicing defrosting fluid, specification MIL-A-8243, for snow, frost, and ice prevention and removal from parked aircraft. The fluid is composed of a mixture of ethylene glycol-propylene glycol in a 3:1 mixture plus a corrosion-inhibiting

For Ambient Temperature Of Fahrenheit Degree	Percent Fluid by Volume	Percent Water by Volume	Approximate Freezing Point of Mixture Fahrenheit Degree
Plus 30° and above	20	80	Plus 10°
Plus 20°	30	70	0°
Plus 10°	40	60	Minus 15°
0°	45	55	Minus 25°
Minus 10°	50	50	Minus 35°
Minus 20°	55	45	Minus 45°
Minus 30°	60	40	Minus 55°

Figure 1. Recommended fluid dilutions of deicing fluid, specification MIL-A-8243

LOCATION	MEAN ANNUAL SNOWFALL (INCHES)
McChord AFB, WA	5.46
Andrews AFB, MD	19.98
Norton AFB, WA	Trace
Scott AFB, IL	23.92
Rhein-Main AB, GE	12.67
Dover AFB, DE	17.11
McGuire AFB, NJ	20.87
Altus AFB, OK	7.19
Charleston AFB, SC	1.43
Kirtland AFB, NM	13.61
Dyess AFB, TX	4.7
Little Rock AFB, AR	7.21
Pope AFB, NC	5.80
Travis AFB, CA	.32

10-Year average snowfall, 1973-1982

compound and a wetting agent. Figure 1 gives the recommended fluid dilutions of Air Force deicing fluid under certain temperature ranges.

A good preflight following ground deicing should include the following general items:

—Wing leading edges, upper surfaces, and lower surfaces.

—Stabilizing device leading edges, upper surfaces, lower surfaces, and side panels.

—High lift devices such as leading edge slats and leading or trailing edge flaps.

—Wing lift spoilers.

—All control surfaces.

—Propellers.

—Rotor blades, rotor heads and controls.

—Windshields.

—Antennae.

—Exposed instrumentation devices such as pitot-static pressure probes and static ports.

—Fuel tank and fuel cap vents.

—Cooling and APU air intakes and exhausts.

—Undercarriage.

Now that your aircraft is squeaky clean of ice, snow and frost, a release for takeoff is in order.

Pretakeoff

The only method currently known to positively confirm that an aircraft is clean of snow and ice prior to takeoff is by a close inspection. A good time for the final check is just prior to the aircraft taking the active runway. In our larger passenger and cargo aircraft, a good rule of thumb is to scan for ice on aircraft surfaces both from the cockpit and from the best vantage point within the cargo compartment.

Crewmembers may elect to open windows, doors or hatches to improve the view. At night, the crewmember must rely upon wing and other aircraft lights. Even these may not provide sufficient reflection to make the appropriate visual observations. If needed, ask for the assistance of qualified ground personnel to help you complete your final visual check. In all cases, *if the AC can't be sure the aircraft is clean, don't attempt the takeoff.*

Assuring the Clean Aircraft Concept

As fliers, we must be aware of how icing can affect our aircraft, and a review of AFM 51-12, Vol I, "Weather for Aircrews," can give us the basics. In preparing for winter operations we should also review our Dash One "cold weather procedures."

Consider also a more specific study on deicing. Whether home station or enroute, we all need to know more about ground deicing and anti-icing procedures. If you would like to learn more about deicing, try a visit to your friendly wing maintenance folks. They have the unheralded yet vital task of keeping our aircraft free of snow and ice. And they have firsthand deicing and snow removal experience gained from many years of battle against winter storms.

Conclusion

The January 1982 crash of Air Florida Flight 90 in Washington, D.C., with the death of 78 people, is a somber reminder to us all of the necessity of removing snow, frost and ice formations from our aircraft prior to flight. In this mishap, the NTSB determined the probable causes were: (a) the flightcrew's failure to use engine anti-ice during ground operations and takeoff; (b) their decision to; takeoff in spite of the snow/ice covering the aircraft's wing surfaces; and (c) the captain's; failure to reject the takeoff when his attention was called to improper engine instrument readings. These combined effects, along with the setting of lower-than-normal thrust by reference to erroneous EPR indications due to ice-blocked inlet probes, led to a condition from which the crew couldn't recover.

Icing, if not heeded, can be unforgiving and deadly. Let's stop this winter weather hazard from making victims of us *this* or *any* other year. ✭

A Failure to Communicate

What was the braking action?

Winter! The word brings to mind thoughts of ice, snow, and gray, overcast skies. On January 23, 1982, Boston's Logan International Airport was experiencing just such a winter day—38°, gray and overcast with the ceiling at 800 feet and the visibility at 2.5 miles in light rain and fog. Its landing runway, 15R, was covered with hard packed snow and glaze ice. It was reopened at 1736 local after an hour of snow removal as darkness approached.

Bound for Boston that evening was World Airways Flight 30H, DC-10 service from Oakland, California, with an enroute stop at Newark, New Jersey. While at Newark, Flight 30H's captain updated his weather forecast and changed his East Coast landing alternates. He also added 10,000 pounds of fuel to the total load and revised the weight and balance computations. At 1848, Flight 30H, with 212 persons on board, left Newark for Logan International.

Fifteen minutes later, Flight 30H's crew contacted Boston approach control. The approach controller vectored the DC-10 onto the VOR final approach course as the crew completed their final checks. Unknown to the inbound mishap crew, several pilots landing at Logan after the reopening of 15R had reported braking action as poor, and one pilot had reported it as "poor to nil."

While descending to 4,000 feet, the captain asked the copilot to select 164 knots

in the autothrottle/speed control (AT/SC) system. This was the approach speed the crew obtained from the charts, but the only operable AT/SC (number 2) didn't "accept" the speed, but gave the crew an "ALPHA" code. This meant, according to the AT/SC, that 164 knots was below the airplane's usual approach speed of 1.3 times its power off stall speed (1.3 Vso) for the configuration of 22° leading edge flaps and 365,000 pounds gross weight. Consequently, the copilot increased the speed in the AT/SC until the "ALPHA" command disappeared. That speed, 174 knots, was 10 knots above the computed speed, but was correct according to company bulletin advising flight crews to accept AT/SC speeds in lieu of flight manual speeds.

At 1932, the World Airways DC-10 was approaching 3,000 feet while the captain maintained a 14° right drift correction to hold the inbound VOR course. Shortly after that, the copilot contacted Logan tower and received clearance to land. As the pilot completed the approach, the copilot called "the ground in sight" at 100 feet above the minimum descent altitude. About 2 miles from the approach end, the copilot saw the approach lights and recalled seeing the visual approach slope indicators (VASIs) indicate "red over red," meaning the plane was below the VASI glide path, not an unusual situation for a non-precision approach. The captain flew the DC-10 back onto the VASI glidepath and continued his descent to the runway.

At 1935:57, Flight 30H touched down on Logan's ice covered runway, some 2,500 feet beyond the displaced threshold. This left just 6,691 feet to stop the hurtling jumbo jet. Immediately, the captain realized he was sliding because of the unusually smooth touchdown. Another giveaway was the fact that the spoilers hadn't automatically extended because the wheels were sliding on the ice.

As the captain lowered the nosewheel onto the runway, he put the engines into reverse thrust and the spoilers then deployed. Several seconds later, the captain applied full reverse thrust and brakes. At 1936:08, about 11 seconds after touchdown, the captain called out "no braking," which was followed 14 seconds later by his second "no-braking" call-out. Realizing there was no hope of stopping on the runway, he steered the aircraft left to avoid the runway 33L approach-light pier. At 1936:40, less than 45 seconds after landing, Flight 30H went over the sea wall and into Boston Harbor.

Immediately upon entering the 4-foot deep water, the wing-mounted engines flooded out, but the tail-mounted center engine kept running at full reverse! As the aircraft dropped from the shore embankment, the nose section separated from the forward fuselage. In the darkness of the crash and emergency evacuation, two passengers are presumed to have drowned. Two other passengers aboard the flight received serious injuries. The remainder escaped with minor injuries and/or exposure to the cold and murky waters of Boston Harbor.

Analysis

As in most complex aircraft accidents, the causes were not as obvious as they appeared at first glance. For instance, the number 1 AT/SC system was inoperative and was a contributing factor to the accident. As mentioned earlier, the number 2 AT/SC system refused to accept a valid approach speed of 164 knots. Had the number 1 system been available to the crew, it would have acted as a backup to check the validity of the approach speed.

Pilots depend on one another to pass on important pieces of information, especially when it concerns flight safety. On that note, only 5 of the 14 flightcrews landing at Logan immediately before Flight 30H passed braking action reports to the tower. The last report, only 8 minutes prior to the mishap, was made by another DC-10 flightcrew who described the braking action as "poor." Yet none of these braking action reports were passed to the Flight 30H crew. The current air terminal information service data had mentioned only "fair to poor" braking conditions.

The National Transportation Safety Board (NTSB) felt that the Logan's tower controllers should have taken more initiative to request braking reports from the previous landing aircraft and should have made a greater effort to relay the braking reports to Flight 30H. The failure of the controllers to tell Flight 30H that the braking action of 15R was poorer than the then-current ATIS report resulted in a gap in the information the crew needed. Had Flight 30H been alerted that one flight had reported braking action "poor to nil" and that two flights immediately ahead of them had both voluntarily reported "poor" braking action with one commercial jet having difficulty stopping on the runway, the mishap crew might have decided to go to an alternate airport or might have employed a more cautious landing technique.

As for the flightcrew, the NTSB investigation showed no overt or excessive pressure placed on the crew to land. As already shown, the braking report information was not as readily available to the crew as it should have been, and the lack of that available information probably lessened the flightcrew's concern about the hazardous runway conditions. The captain's decision to land the aircraft using the AT/SC system resulted in a landing speed 10 knots higher than the World Airways approach speed for the configuration and weight of the plane. That speed was also 15 knots higher than the optimum reference speed for the airplane's estimated gross weight. But the speed was accepted by the flightcrew when it was determined to be the minimum airspeed which could be selected using the AT/SC system.

Because of the pilot's decision to land with 35° flaps due to the possibility of encountering a wind shear on final, instead of 50° flaps as the airline recommended for "contaminated" (or icy) runways, the distance needed to stop the DC-10 increased between 300 and 500 feet. But the corresponding higher approach speed, derived from the AT/SC and the longer flare and touchdown extended that distance still another 400 to 500 feet. In all, considering the AT/SC-derived higher airspeed, the 35° flap setting and 365,000-pound landing configuration, plus the braking and reverse thrust application times, the total runway length needed to stop Flight 30H was between 7,360 and 8,390 feet. Since runway 15R had a usable length of 9,191 feet and since the crew landed well down the runway, they were obviously in trouble. According to the NTSB analysis, once the landing was made, stopping the airplane on the runway may have been impossible regardless of crew performance.

Probable Cause

In presenting the reasons behind this accident, the NTSB determined the probable cause was that the pilot landed the airplane without sufficient information as to runway conditions on a slippery, ice-covered runway, the condition of which exceeded the DC-10's stopping ability. That lack of information was due to; (1) the FAA regulations not providing guidance to airport management regarding the measurement of slippery runways under adverse conditions; (2) the FAA regulations not providing the flightcrew and other personnel with sufficient means to correlate contaminated surfaces with airplane stopping conditions; (3) the FAA regulations not extending authorized minimum runway lengths to reflect reduced braking effectiveness on icy runways; (4) the Boston-Logan International Airport management failing to exercise maximum efforts to assess and improve the conditions of the ice-covered runways to assure continued safety of heavy jet operations; and (5) tower controllers failing to transmit available braking information to the pilot of Flight 30H.

Contributing to the accident was the failure of pilot braking reports to convey the seriousness of the hazard to subsequent landing pilots. The mishap pilot's decision to retain autothrottle speed control throughout the flare and the consequent extended touchdown point also added to the severity of the accident.

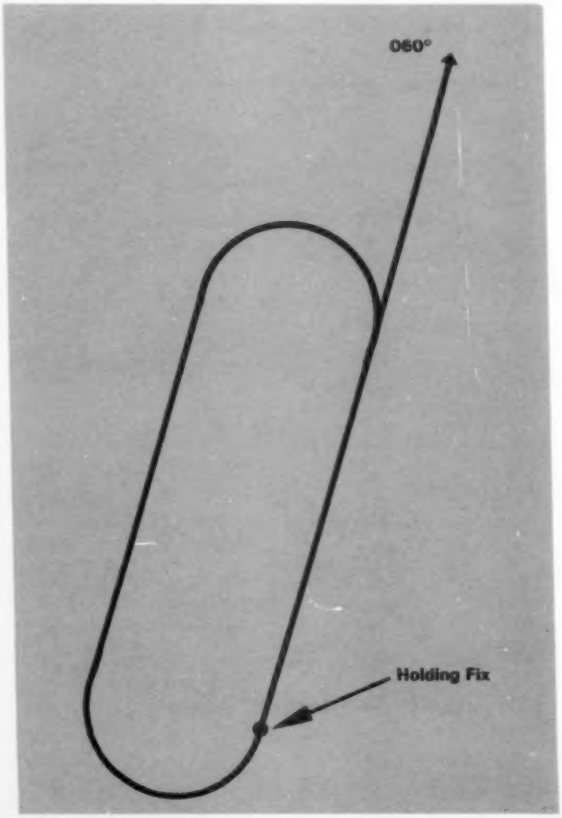
Thinking about winter operations now and in the months to come, keep in mind all those factors that can adversely affect aircraft performance, both on the ground and in the air. If you see or otherwise experience a condition hazardous to the crew behind you, be *sure* to pass it on. And it goes without saying that knowing what's in the Dash One is good, but *understanding* what the words mean is safer—for everyone!

—Adapted from NTSB AAR 82-15

A review of holding patterns...

Say Again All After "ATC Clears"

Editor's Note: From time to time, we (aircrews) find it necessary to delve back into that myriad of publications, known collectively as "Instrument Procedures," to resurrect some obscure piece of knowledge necessary to complete the requirements of the annual instrument checkride. Foremost of those tidbits we sometimes overlook is the information on holding patterns. With that in mind, we thought you might like to try your hand at the following little quiz (results are not reportable except to C.R. Terror) and see just how much you recall. It's not as easy as it looks, so remember to read each question carefully. (The answers appear on page 24.)



1. The depicted holding course is:

   a. 040°.
   b. 260°.
   c. 060°.
   d. 240°.

2. This holding pattern is:

   a. standard
   b. non-standard
   c. hardly standard
   d. it ain't possible to tell with the drawing, Dilbert!

3. If the depicted holding fix were your clearance limit, you would reduce to your maximum holding airspeed:

   a. upon passing the fix and entering holding.
   b. within 3 minutes of the holding fix.
   c. at least 3 minutes from the holding fix.
   d. 5 minutes from the holding fix.
   e. ½ hour or 30 minutes from the fix, whichever is less.

4. Flying a turboprop at 14,000 feet MSL, your max holding speed is:

   a. 210 KIAS.
   b. 210 KCAS.
   c. 175 KIAS.
   d. 175 KCAS.

5. Holding at 14,000 feet MSL (no wind), the total time to complete one circuit in the holding pattern (assume TAS allows a standard rate turn) is:

   a. 4 minutes.
   b. 3 minutes.
   c. 5 minutes.
   d. 6 minutes.
   e. with C.R. Terror flying, about 30 seconds!

6. If the depicted holding fix were a VOR station, you should begin the turn to the outbound leg when:

a. the bearing needle swings past the wingtip.
b. the bearing needle exhibits the initial "wiggle."
c. the TO/FROM indicator makes its first complete reversal.
d. the DME indication stops decreasing.
e. none of the above—we've got Omega.

7. You're entering a racetrack (ICAO) which has 3 minute legs. From a teardrop entry you should turn to parallel the outbound course after:

a. 30 seconds.
b. 2 minutes.
c. 1½ minutes.
d. reaching the "stretch."

8. The depicted fix has miraculously turned into an NDB. Approaching the fix from the northeast, the outbound leg timing begins:

a. when I start my gold-plated Silicon Strip stopwatch/radio scanner.
b. upon passing the fix and turning outbound.
c. abeam the fix outbound.
d. when wings level, outbound.

9. The depicted holding fix is now, miraculously, a VOR. (Would you make up your mind?) You're proceeding to the VOR on the 350° radial and due to a strong east wind, your heading is 160°. Your entry turn would be:

a. to the left.
b. to the right.
c. not required.
d. okay either left or right.
e. do a loop and enter holding vertically.

10. Approaching the holding fix at 15,000 feet MSL, you encounter moderate turbulence. Your recommended turbulent air penetration speed exceeds the max holding speed listed for your airplane. You should:

a. Increase to turbulent penetration speed and notify ATC immediately.
b. Coordinate with ATC to try to leave the area of turbulence.
c. If the higher speed becomes unnecessary (you got out of the bumps), slow to published holding speed and advise ATC.
d. All of the above.

11. The maximum length of the initial outbound leg (no wind) of a holding pattern at 15,000 feet MSL is:

a. 1 minute.
b. 45 seconds, approximately.
c. 1.5 minutes.
d. whatever feels right.

—*Adapted from* Professional Pilot.

ANSWERS

1. (d) The holding course is the depicted inbound course to the holding fix.
2. (a) The standard holding pattern is one with right hand turns.
3. (b) You're expected to start your speed reduction when you're 3 minutes or less from the holding fix to cross the fix at or below the specified maximum holding airspeed. You may, however, begin speed reduction sooner with ATC approval.
4. (b) The normal maximum holding airspeed for turboprop and prop-driven aircraft is 175 KIAS.
5. (a) Leg lengths are 1 minute each and each standard rate turn (3°/second) takes 1 minute.
6. (c) When holding at a VOR station, pilots should begin the turn to the outbound leg at the time of the first complete reversal of the TO/FROM indicator. (Positive FROM indication)
7. (c) Didn't think we'd let the new ICAO methods pass by, did you?
8. (c) Because the holding fix is an NDB, bearing information is provided for the abeam position.
9. (a) The proper entry turn is based on the aircraft's heading upon arrival at the holding fix. The 160° heading puts you in a position where you should turn outbound in the shorter direction (left turn in this case) to parallel the holding course.
10. (d) Because turbulence, icing and other considerations may necessitate a higher airspeed, there are provisions for airspace protection based on turbulent air conditions. You must advise ATC because considerable impact on traffic separation can result.
11. (c) The initial outbound leg should be flown for 1½ minutes at 15,000 feet MSL.

C.R. TERROR

Nightmares of the Neophyte Nav

Precision navigation, m'lad. I expect it, I require it," explained the Herky Honcho as he managed to spill coffee (three sugars, two creams) over the replacement nav's woefully misplotted charts. "Now don't fret, Lieutenant Lop. Is that your name? Oh, it's Lieutenant Will Plop? Well, anyway, don't you worry," C.R. consoled as he continued to drop grease-soaked fried chicken crumbs in a random pattern over the nav's plotter, dividers, and Air Almanac page. "Your chart will fry, I mean dry, by coast out at Farallon Island," C.R. continued, wiping his greasy fingers on the nav's flying jacket.

"Boss, how's Blinky doing?" asked Sammy, the chipper right-seater, strapping in for their C-130 flight to Hickam. "He didn't look any too good when the orderlies in the white coats carried him away yesterday."

"Glad you asked, Sam," C.R. intoned as he put down his chicken wing on the nav's range control chart. "It doesn't look like medical retirement yet, though his nerves are pretty frazzled. The doctor even had the audacity to blame *me* for Blinky's condition. I guess Blinky screaming 'Terror, Terror' for 6 straight hours didn't help. Anyway, the doc believes my leadership in multiple safe flying adventures has pushed Blinky near the edge. And they also seem to think ol' Blinky may have picked up a stomach ailment from 6 months of eating the standard fare of MAC's finest overseas flight line snack bars."

Sergeant Torque questioned, "You mean jalapeno peppers, chili-con-carnage, and burrito specials? All that standard MAC fare?"

"Of course," C.R. continued. "These 'vending machine specials' are excellent cuisine. Must have been a bad can of something, but times a wastin'. On with the checklist and the takeoff."

"Pilot, nav. I hear water

sloshing around in my sextant," Plop politely pleaded. "Can we get another sextant that hasn't absorbed so much moisture?"

"Nonsense, lieutenant," C.R. blustered. "Can't afford to delay the mission, ya' know. We're shooting for an on time takeoff this time," C.R. continued, mentally counting on the toes of one foot, the number he had actually made on time. Not long afterwards the lumbering, brown and green flying machine was climbing out of McClellan to a cruise at FL 220.

"Boss, I really wanted to program my Omega on the ground," the nav hinted, "not to mention preflight my nav gear and this water-logged sextant."

"Of course, and preflight it you shall, only you'll be checking it out airborne. This is just a routine over-water sortie, not a checkride. Anyway, Blinky gave the nav gear his personal glance of approval before he passed out. Besides, we can't afford to wear out our sophisticated and expensive C-130 navigation equipment in excessive preflights," explained the Long-winded Warrior.

"Pilot, nav, can you hold it steady for a true heading check?" Plop requested as he lined up his celestial shot on the sun.

"No problem, nav. Our autopilot is a little skittish, but with my golden hands, we'll keep it rock steady," promised the Modest Major. True to his limited ability, C.R. immediately entered a shallow right bank with slight 3-5° heading deviations. "Wind shear and some pesky turbulence," C.R. bluffed, never at a loss for an excuse.

True to his own similar mastery of the nautical arts, Plop computed his deviation check backwards resulting in a 4° heading error for the remainder of the flight.

"Oakland Oceanic, Lemming 23 checks by Bebop, time 1408, FL 220, Bluff next," Sammy radioed at the first compulsory reporting point past Farallon. Plop, meanwhile, was pacing himself leisurely with 80 minute fixes.

"Pressure's good, celestial's good, doppler's good, but the Omega seems to be wandering off," reported Plop on the half hour. "But we'll be within 4 miles of course and 5° of heading at the Hawaiian ADIZ. I'll stake the first round at the Purple Lagoon on it," he boasted.

"A reasonable and generous offer, Willie Plop," reasoned C.R., intent on quaffing the fruits of the wager. "Of course, I'm pretty good myself. I've airplotted across the Atlantic to Europe myself in my day."

"But weren't we supposed to land at Ascension, Boss?" Sammy giggled.

"Major Terror, didn't your own special version of grid navigation give your crew the scenic route to Thule via Keflavik once?" Plop recalled an oft-recounted legend from the squadron.

C.R., silenced by the jibes of his soon-to-be ex-crew, nodded off to sleep, huffing, "Well, I'm certainly more reliable than these high-tech nav systems like doppler or pressure, D.R.-Breath."

Over the next 5 hours, Plop talked less and less as his nav equipment failed piece by piece. First to go was the doppler, sliding into semi-permanent memory mode even in sea-hi. Next was Omega when it dropped down to two stations with the D.R. light coming on.

"Major Terror, Major Terror, wake up!" exclaimed Plop. "My Omega has just gone into 'warn' and the doppler's out. Better advise oceanic control that we've got minimum nav aids," the now very nervous neophyte nav pleaded.

"You must be kidding, nav," said C.R. awakening

from his rendezvous at the oasis. "They look for you when you coast in to see if you're off course. We'll be on course so there's no need for us to call them now."

Plop wanted to protest the flim-flam but realized the futility of that task, "Well, I'll just get those cel precomps a'workin' and concentrate on my pressure. With a little luck and a strong Honolulu radio station, we'll hit the Hawaiian ADIZ right on the numbers."

C.R. smiled sweetly and added, "Consider this as an opportunity to excel, nav!" Conveniently, C.R. forgot he had himself transformed many such "opportunities" into unmitigated disaster, always competent in snatching "defeat from the jaws of victory."

Within a short time, Lieutenant Plop managed to work himself into a frenzy nearing the ADIZ with unreliable nav systems. "Well, we're right back on centerline, folks," he conjectured, breathing a sigh of relief, unaware that he had erroneously plotted the last six celestial intercepts as "towards" instead of "away." Plop, oblivious to the world, mumbled to himself, "If only my old celestial instructor, Major Homoto, could see me now." Unfortunately, Willy had been equally inept at plotting pressure lines of position (PLOPs). His were consistently off by 7-20 miles.

C.R., awakened for the ADIZ penetration and coast in, was carefully briefed by the nav that all was well except for the equipment malfunctions. C.R., not quite believing the nav, decided to use his own fickle faculties for navigation and reached for the most precise navigation instrument available. Quickly, he transmitted over a known commercial frequency, "Clipper, Clipper, this is the Bandit, I mean this is Lemming 23."

A commercial 747 rapidly overtaking the Herk and high above took the call. "Lemming 23, this is Clipper 1. What can we do for you today?"

"Roger, Clipper, see any C-130s below you at FL 240? If you do, could you give us a navigation fix?" the Ace of Aerospace queried, his worry masked by his booming voice.

"Roger, Lemming 23, we've got you well below us at 10 o'clock. You've got part of a life raft deployed on your right wing, right?".

C.R. merely mumbled, "Yeah, that's probably us." Smart aleck ex-C-130 pilots, C.R. thought to himself.

"Lemming 23, as we passed over, you were about 140 miles northeast of Bitta."

"Thanks for your help Clipper," C.R. replied. "Nav, how does that check with your data?"

Plop quickly plotted the Clipper data for his first solid fix of the trip even though it indicated he was at least 50 miles north of course. "Good data, sir. Pilot, we've got a slight correction to make in the next 100 miles or so before we hit the ADIZ. Come left 45° for about 5 minutes. Then right back to course. If we're lucky we'll squeak right by and won't get violated."

C.R., sensing the desperation in the nav's voice, quickly used the airwaves again. "Honolulu ARTCC, Lemming 23 has a revised estimate for Bitta. We're deviating slightly north of course for some clear air turbulence. Request radar vectors direct Koko Head for continued air sampling."

Sergeant Ty Downs, listening in on the jumpseat interphone, tapped C.R. on the shoulder, "Hey Boss, I didn't know we were on an air sampling mission. Should I open the ramp or something?" C.R. merely scowled in disgust as he waited for Honolulu's reply.

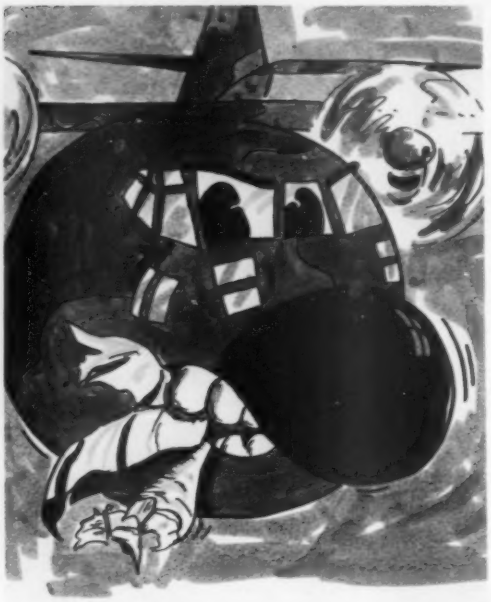
"Lemming 23, Honolulu. You're cleared direct Koko Head. Fly 220° magnetic until receiving the station, then cleared direct," radioed the courteous Hawaiian controller, chuckling at Lemming 23's imaginative tap dancing out of a sure violation. "We've had no reports of turbulence or air pollution in your area. Glad you guys are checking it out. Thanks for the update."

The Winded Warrior breathed a sigh of relief and turned to his now humbled nav, "Can't have us spending our time on the ground filling out OPREP-3s and nav violations, Willy m'lad. Now I know what min-nav means! However, I do think you need to be chastised. How you can navigate with such grease-stained charts is beyond me. Anyway, you *did* say you were buying the first, middle, and last rounds at the Purple Lagoon, right?"

The nav merely nodded his head affirmatively and smiled weakly. Quickly reassessing the situation, and bowing to the inevitable, Willie suddenly became jovial again, "Why I'll be glad to Plop for several rounds."

And so he did.

Quick Stoppers



Camouflaged Tree Trimmer

Sometimes it just doesn't pay to be careful. A C-130A crew recently made a stop at an unfamiliar civilian airport. As the Herk taxied out for takeoff, it became evident the right wingtip would come close to a flight service station (FSS) compound located near the taxiway. Recognizing the need for cautious taxi procedures, the AC moved the C-130 to the left of the taxiway centerline in order to create greater clearance between his aircraft and the FSS facility. Unfortunately, the crew was so worried about the FSS hazard, they failed to see a small palm tree in their immediate vicinity. Result: the Herk's right wing struck the fronds of the tropical decoration. Damage was limited to minor sheet metal deformity of a leading edge section. Good thing it wasn't an oak—or a stand—or another aircraft.

Sabreliner Snow Cone

The CT-39 was on a routine mission to the warm climes of Florida and had been level at FL 350 for 40 minutes when the copilot noticed the horizontal trim had failed at 2.6°. The crew ran through the Dash One emergency procedures, but were unsuccessful in restoring stabilizer trim in either the normal or alternate modes. Unable to solve their problem, the Sabreliner crew diverted back to their home station and made an uneventful no-flap approach and landing. Gear lowering did not restore their trim, but it started to function normally again during the landing roll.

The maintainers found considerable moisture in the stabilizer area, possibly the result of an encounter with heavy rain during the aircraft's climb out from the departure station. Following a thorough inspection of the trim system, it functioned normally and the aircraft was released for flight.

On the first leg of the next flight, though, the identical problem returned and the crew once again made an unplanned recovery at the homedrome. This time the maintenance technicians disassembled the horizontal trim actuators and were amazed to find approximately 1 ounce of water *inside* each actuator. The source of the water is unknown, but is suspected to be the result of condensation. In both instances, once the aircraft reached cruise altitude, the water inside the actuator froze rendering the acuators inoperable and resulting in complete loss of stabilizer trim.

Card Tricks

Approaching the European destination, the C-5 AC called for gear down and the before-landing checklist. The main landing gear quickly went to the down and locked position (green wheels) but the nose gear stopped in the "in transit" position which indicated the nose gear doors were neither open nor closed completely. The crew then went to the emergency nose landing gear extension normal hydraulic pressure available checklist to get the nose wheels down. Unfortunately, this checklist failed to achieve the desired results when one nose landing gear door indicated open and the other indicated closed on the landing gear sequence panel. This left the crew with the unenviable task of making a nose gear-up landing. But, good fortune finally smiled on the Galaxy crew.

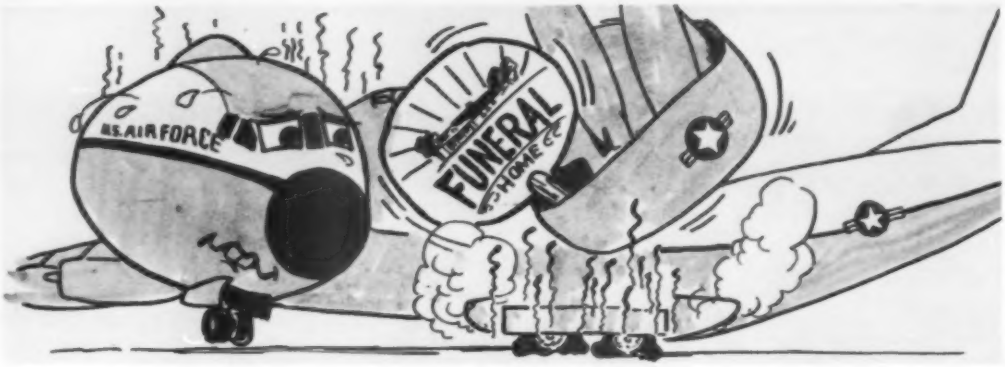
Another aircraft was airborne in the C-5's vicinity and was cleared to join on the Galaxy. The "chase" crew was able to visually confirm that both of the C-5's nose landing gear doors appeared to be fully open. Armed with this information, the C-5 crew extended the nose gear by manually repositioning the hydraulic control valves in accordance with tech order procedures, and soon had green wheels for all the gear. An uneventful landing followed. Maintenance troubleshooters quickly located the cause for the near gear-up landing—a faulty nose landing gear circuit card.

A-Model Anomaly

Yessir, folks, the old A-model is different. Consider the vintage Herk taxiing for takeoff recently. The copilot moves the brake selector switch from emergency to normal while accomplishing the taxi checklist. As he does this, the aft hydraulic line to the emergency hydraulic hand pump, located on the floor next to the copilot, fails. Since most hydraulic fluid is under pressure, and this is no exception, the results are predictable and the copilot proceeds to take a shower in the mil-spec red liquid. There's hydraulic fluid on the seats, there's hydraulic fluid on the oxygen regulator—there's hydraulic fluid *everywhere*! It's hard to think clearly in a situation of this kind with all that hydraulic fluid around you, but the copilot did.

The alert copilot blocks the spray with his pubs bag and finally isolates the problem by turning off both utility boost pump switches and the electric suction boost pump. Our now thoroughly drenched flight crew pull the Herk back into parking, shut 'em down and head for the showers. All in a day's work.

This is really no laughing matter for all early model Herk drivers. While it may have seemed comical at the time, hydraulic fluid is flammable and toxic, and at high pressure can do significant, even catastrophic, damage to you or your aircraft.



Starlifter Re-tires

Following the usual 1 mile taxi to the active runway, the Starlifter was cleared into position for a planned standing takeoff. During the takeoff roll at approximately 123 knots, the jumpseat occupant and the pilot both observed a medium-sized bird in front of the aircraft crossing from right to left towards the numbers 1 and 2 engines. At about the same time, the entire flight deck crew heard a noise that sounded like a compressor stall and the AC called "reject!" Both pilots applied the brakes, the copilot deployed the spoilers and the AC went to reverse thrust to stop the 311,000 pound aircraft. The reject procedures worked as advertised and the aircraft was slowed to taxi speed with 1,000 feet of runway remaining.

Once clear of the runway, the engineer got out the charts to figure the cooling time and energy absorption level of the brakes. Meanwhile, the scanner was cleared off the aircraft to visually inspect the gear. Since the brakes were in the caution zone at 24.5 million ft. lbs., the crew called for the fire trucks, chocked the nose gear, shut down the engines and evacuated the aircraft.

Once the wheels and brakes had safely cooled, maintenance discovered six main landing gear tires were worn beyond limits and four wheels and brakes had to be replaced. The tires were damaged beyond repair due to melting around the bead area from heat dissipating from the wheels.

The aircraft was thoroughly inspected and no evidence of a bird strike or compressor stall was found. A search of the runway also failed to reveal any carcass or remains of the bird observed by the crew.

A review of this mishap revealed the C-141 brake limit charts do not take into account the added brake temperature caused by long heavyweight taxi or braking before takeoff. Crews should be aware of the potential for increased brake temperatures caused by these circumstances.

Notable Quote

"There is nothing to be said in favor of war except that it is the lesser of two evils. It is better than appeasement of aggression, for appeasement encourages the aggressor it seeks to avoid; and it is far better than submission to tyranny and oppression, because without freedom and respect for human dignity, life would not be worth living."

Former Secretary of Defense George C. Marshall (1950)

After Deadlines

USAF INSTRUMENT FLIGHT CENTER REACTIVATES—On 1 October 1983, the USAF Instrument Flight Center (IFC) was reactivated at Randolph AFB, Texas. The roots of the IFC go back 40 years to the founding of the Army Air Corps Instrument Pilot School at Bryan Field, Texas. Today's IFC will prepare and monitor Air Force directives and publications governing instrument flight; determine USAF operational requirements for flight information; and develop, coordinate, validate and test instrument flight requirements, concepts, techniques and procedures. In addition, the IFC will perform initial and follow-on operational testing and evaluation of control, display, and guidance systems. The organization will initially have approximately 24 personnel representing all major commands and should be fully operational by 1 February 1984. For more information on IFC, contact Lieutenant Colonel Jim Curran, Autovon 487-5071.

CT-39 REPLACEMENTS ANNOUNCED—Gates Learjet Corporation and Beech Aircraft Corporation, both of Wichita, Kansas, have been awarded firm fixed-price contracts for replacement of the CT-39 operational support aircraft fleet. Gates Learjet will furnish 80 Learjet Model 35A (C-21A) turbofan aircraft and Beech Aircraft will provide 40 Super King Air B200C (C-12F) turboprop aircraft under a 5-year lease agreement. The 120 new aircraft will be assigned to 19 bases around the world. Maintenance will be provided by the contractors who will furnish the people, tools, support and test equipment, spare parts and depot support. Deliveries start in the spring of 1984 at a rate of four to eight aircraft per month. Complete CT-39 phase-out is expected by 1986. (MNS).

PICTURES NEEDED—The Headquarters MAC Operations Briefing Section needs your pictures of MAC operations around the world. Your photos will be used in the daily briefings to CINCMAC and his staff. Please include a caption describing the photo along with the location of the shot. All pictures will be returned if you include your name and unit address. Please send photos to HQ MAC/DOCB, Attn: SSgt Callahan, Scott AFB, Illinois 62225.

MAC AIRCRAFT GET VOICE RECORDERS—MAC's C-141 and C-130 fleets will be equipped with cockpit voice recorders (CVRs) by 1985. Crash survivable, the new systems will enhance aircraft investigation board efforts to determine mishap causes. The CVRs will record radio traffic, interphone communications at selected aircrew positions and all conversation in the cockpit area. (MNS)

NEAR CATASTROPHE—Recently a MAC C-130 departed a non-MAC base *without* tower clearance for takeoff. But not only did the Herk crew depart without clearance, they took off against traffic with an emergency aircraft on final! Luckily, no conflict ensued. Although the C-130 crew was at fault in this instance, they had some help in the form of a complex and confusing tower clearance to take the runway for a back-taxi. If ever in doubt about a clearance, stop and clarify it before proceeding.

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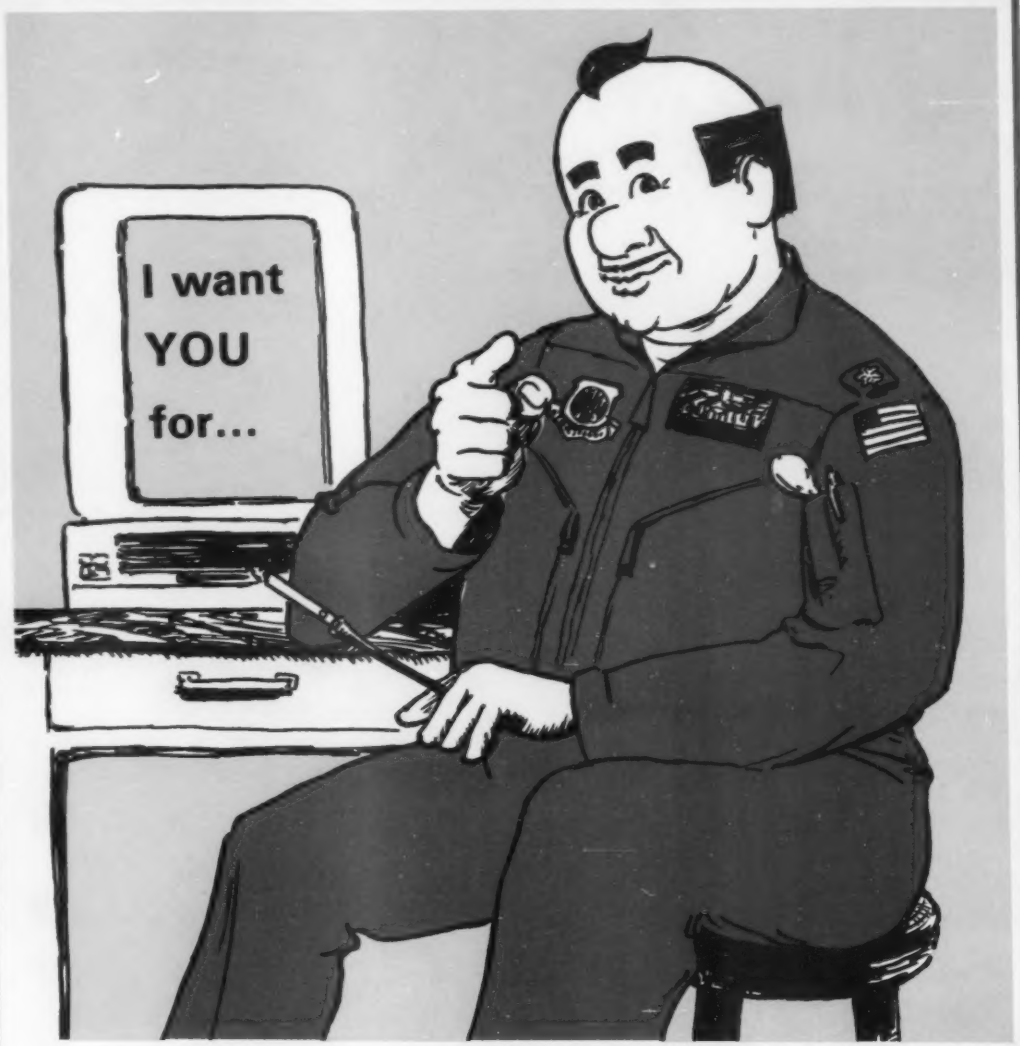

THE MAC Flyer

MILITARY EDITOR VACANCY FOR *THE MAC FLYER*—We have an opening in April or May 1984 for an Associate Editor for MAC's flight safety journal. We need a company grade pilot or navigator with rescue, special operations, or tactical airlift experience. Ambition and ability to tell a good story are strong qualifications. Flight safety and/or public affairs experience a plus. Desired PCS date in April or May 1984. Interested officers should contact Major Jim Lee, Supervising Editor, Autovon 638-3534, or write to HQ MAC/IGFE, Scott AFB, IL 62225.